

Wildman, J., McMeekin, P., Grieve, E., and Briggs, A. (2016) Economic evaluation of integrated new technologies for health and social care: Suggestions for policy makers, users and evaluators. *Social Science and Medicine*, 169, pp. 141-148. (doi:10.1016/j.socscimed.2016.09.033)

This is the author's final accepted version.

There may be differences between this version and the published version. You are advised to consult the publisher's version if you wish to cite from it.

<http://eprints.gla.ac.uk/130861/>

Deposited on: 04 November 2016

Economic evaluation of integrated new technologies for health and social care: suggestions for policy makers, users and evaluators.

John Wildman^{a*}, Peter McMeekin^b, Eleanor Grieve^c and Andrew Briggs^c

^a Economics, 5 Barrack Road, Newcastle University Business School, Newcastle University, Newcastle Upon Tyne,

*corresponding author: email: john.wildman@ncl.ac.uk

^b Health and Life Sciences, Northumbria University, Newcastle Upon Tyne

^c Institute of Health and Wellbeing, University of Glasgow, Glasgow, Scotland

Abstract

With an ageing population there is a move towards the use of assisted living technologies (ALTs) to provide social care and health care services, and to improve service processes. These technologies are at the forefront of the integration of health and social care. However, economic evaluations of ALTs, and indeed economic evaluations of any interventions providing both health benefits and benefits beyond health are complex. This paper considers the challenges faced by evaluators and presents a method of economic evaluation for use with interventions where traditional methods may not be suitable for informing funders and decision makers. We propose a method, combining economic evaluation techniques, that can accommodate health outcomes and outcomes beyond health through the use of a common numeraire. Such economic evaluations can benefit both the public and private sector, firstly by ensuring the efficient allocation of resources. And secondly, by providing information for individuals who, in the market for ALTs, face consumption decisions that are infrequent and for which there may be no other sources of information. We consider these issues in the welfarist, extra-welfarist and capabilities framework, which we link to attributes in an individual production model. This approach allows for the valuation of the health component of any such intervention and the valuation of key social care attributes and processes. Finally, we present a

set of considerations for evaluators highlighting the key issues that need to be considered in this type of economic evaluation.

Keywords: Assisted Living Technologies; Economic Evaluation; Multi-dimensional outcomes; Attributes; Capabilities; Health and Social Care

1 Introduction

In the face of an increasingly dependent population there is a need to find solutions to the associated increases in health and social care costs. The OECD projects that the proportion of individuals over 80 will increase from 4% to 10% by 2050 (Colombo et al., 2011), with the projection that health care spending will rise from 6.7% of GDP in 2007 to 13% by 2060 for the 27 European Union (including Norway) countries (Appleby, 2013).

Technology, in the form of assisted living technologies (ALTs), has become a focus for health systems and researchers as a potential solution to increasing costs. ALTs cover interventions such as telehealth, telecare and technology items. They can be home and environmental modifications that may promote independence and safety, and so improve wellbeing and reduce the demand for health and social care services. Such interventions are aimed at older and potentially vulnerable younger populations.

ALTs may be provided by the market or by the public sector. However, there have been concerns regarding the ability of the market to provide scalable ALTs to consumers (Li et al., 2014). Further, it is believed that perceptions of the effectiveness of ALTs are mixed (de Leonibus et al., 2013). For the time being it may be preferable for ALTs to be provided by the public sector in which case the benefits, and more pertinently, the cost-benefit of ALT interventions need to be demonstrated. This is important for ensuring that public money is spent efficiently. Furthermore, robust evaluation of

1 ALTs may help to provide information for individuals in the private market, helping it to grow by
2 overcoming the problems surrounding the perceptions of the effectiveness of ALTs.

3 Evaluating ALTs is challenging. Graybill et al. (2014) find that economic evaluations of ALTs are rare,
4 and those that have been conducted are often of poor quality. One area where rigorous evaluations
5 have been conducted is the 'Whole Systems Demonstrator' project (Henderson et al., 2013,
6 Steventon et al. 2013), a large randomised controlled trial of telehealth and telecare. However, the
7 cost-effectiveness results were largely inconclusive.

8 The problem for evaluations may not be the way they are conducted so much as the way current
9 methods are applied. This paper addresses the issue of whether the standard evaluation methods
10 used in health care are suitable when considering ALTs and indeed any intervention where there are
11 multiple outcomes, including processes, that may extend beyond health. The key contribution of this
12 paper is the development of an approach to evaluation that combines current methods in order to
13 value health outcomes and outcomes beyond health alongside one another. The approach retains
14 the CUA basis of valuing health that has been widely used and accepted in the economic evaluation
15 of health care interventions (Drummond et al. 2005). We suggest the use of qualitative and
16 quantitative elements that combine cost-utility (CUA) for valuing health with cost-benefit analysis
17 (CBA) for valuing outcomes and processes beyond health. We also suggest that robust evaluations
18 can benefit both the private sector and the public sector and may help to overcome the problems
19 that currently affect the private market.

20 This approach has several innovative elements: firstly, we combine existing methods from economic
21 evaluation while maintaining the extra-welfarist approach to valuing health outcomes. Secondly, we
22 show how it is possible to link economic theory regarding attributes to a capabilities approach,
23 allowing the new method to encompass wider elements of capabilities than has already been
24 achieved. Thirdly, our process would allow individual attributes to be valued, revealing which
25 elements are important in services providing a range of outcomes and how they are traded-off

1 against each other. Finally, the approach is highly flexible because the use of a consistent numeraire
2 (either monetary or health) means that programmes can be compared even if the underlying
3 attributes differ.

6 **2 Assisted Living Technologies**

7 ALTs can benefit individuals in need across the whole age range. Generally, ALTs fall into two
8 categories: *Home and Environmental Modifications*, technologies installed to promote independence
9 and mobility and to mediate the risk of injury; and *Telemedicine*, technologies that provide remote
10 communication between people in their home and healthcare, social care or security professionals
11 (Graybill et al., 2014).

12 Demonstrating value for money is important for any intervention that requires public funding and
13 there may be good reasons for publicly funding ALTs even though they may fall outside the
14 traditional remit of health care systems (Li et al., 2014). Firstly, the market for ALTs is not well
15 developed because ALTs are in their infancy. Secondly, the market may be affected by the presence
16 of large public sector health and social care providers that may crowd-out private providers.

17 Individuals may have an expectation, in systems that rely on social insurance or taxation, that
18 technologies providing health and social care should be provided by public funds. Thirdly, the
19 provision and market for ALTs may not be trusted due to consumers having little experience of
20 interacting in such a market. Indeed such markets have been highlighted as potential areas for
21 scams, hindering market development (<http://www.bbc.co.uk/news/business-15097985>). Finally, for
22 markets to work it is important for consumers to have information. Due to the novelty of many ALTs
23 there may be little information regarding their quality and efficacy as interventions. A recent report
24 on the market for ALTs did find a public perception that ALTs may not be effective (de Leonibus et

al., 2013). In fact many individuals go to (traditionally public sector) health care and social care professionals in order to obtain information regarding effectiveness. These information gaps mean that individuals may not be willing to pay for ALTs that they would otherwise purchase had full information been available.

The evaluation of ALTs may provide a benefit to the private market if evaluation becomes a source of information that highlights the efficacy of ALTs. Evaluations would build a body of evidence regarding which interventions are value for money. This may filter into the private market, which, as it develops, may reduce the need for public provision. However, public provision may always be necessary due to equity concerns, although we will not cover these in this paper.

3. Economic evaluations

The concern is whether methods of economic evaluation that are commonly applied in health care - cost-effectiveness analysis (CEA) and CUA - are appropriate for new technologies where there are multiple outcomes, including process value, that extend beyond health. While CEA and cost-consequence analysis (CCA) are useful forms of evaluation they may not be appropriate, either because they are only partial economic evaluations or because they are restricted in the measures of outcomes and focus on issues of technical efficiency. Our focus is on broader approaches such as CBA or CUA.

3.1 CBA and welfarism

Economics approaches evaluation through the paradigm of welfare economics - benefits are restricted to those accruing to the individual (in terms of utility gains). The welfarist approach

1 applies CBA, comparing the discounted future streams of incremental programme benefits with the
2 incremental programme costs to measure the net social benefits (Drummond et al., 2005).
3 CBA considers issues of allocative efficiency across and within sectors and may be suitable when the
4 outcomes are varied and process, such as the method of delivery (eg whether at home or at a
5 provider), may also be of value. However, CBA can be difficult to undertake as the values can be
6 confounded by ability-to-pay (Donaldson, 1999), and in the case of social care and health care
7 interventions, confounded by potentially increasing expectations of the role of the state in their
8 provision (Ham et al., 2012). Furthermore, in practical application, it seems that traditional CBA-
9 based welfare economic analysis has not been widely accepted as the evaluative method of choice in
10 the health care setting.

12 **3.2 CUA and 'extra-welfarism'**

13 In rejecting the traditional welfarist approach to health care evaluation, the predominant evaluative
14 technique to emerge is the 'extra-welfarist' approach, which focuses on the benefits from
15 fundamental goods and their distribution and underpins most of the economic evaluations in health
16 (Culyer, 1989, Hurley, 2014). According to Coast et al. (2008b) extra-welfarism grew from the work
17 of Sen (1980, 2002) focusing on functionings and capability – the ability of individuals to function.
18 Sen has suggested functionings such as 'moving' or 'being in good health' and it is the focus on the
19 latter and the ability for an individual to be in good health that has led to the development of extra-
20 welfarism. This notion of extra-welfarism is quite narrow (Coast et al., 2008b) and meant that in
21 economic evaluations of health interventions the fundamental good is health. This has led to a focus
22 on using quality adjusted life years (QALYs) as the main currency of outcome measurement (for an
23 excellent discussion of the welfarism, extra-welfarism and capabilities see Coast et al., 2008b). This

approach, using QALYs in combination with the cost-utility analysis method, specifically does not place value on benefits outside of health gains.

In order to capture benefits beyond health an alternative approach to the method we are suggesting would be to move away from a health focused version of 'extra-welfarism' and develop a broader utility measure to use in CUA, such as the 'capability-QALY' proposed by Cookson (2005), the 'super-QALY' as described by Buxton (2008), or the WELBY (wellbeing adjusted life years) (Brazier and Tsuchiya, 2015). A super-QALY measure would require knowledge of what people value that might be affected by the intervention and a means to capture those effects. Similar problems would be raised by the use of the WELBY, which would also risk removing much of the focus from health.

4. The challenges of conducting economic evaluations on ALTs

ALTs present many challenges for the traditional economic evaluation approaches. These challenges may explain why cost-effectiveness studies have struggled to make the case for ALTs in the past.

4.1 The outcomes of ALTs

Using CUA methods with QALYs is the core economic evaluation tool used to investigate value for money in health care. However, focusing on health benefits from the 'extra-welfarist' position is challenged by the possibility of multiple outcomes (Birch and Donaldson, 2003). For ALTs there are outcomes that may be important for health, for social care and for process - improving health and social care may partly revolve around service delivery rather than solely on outcomes. The focus on health and QALYs seems inappropriate in this context and broader measures of outcomes are required. Sen's (1980) notion of capabilities, which is already gaining ground in the area of health (Coast et al., 2008a, Coast et al, 2008c), could provide a way forward.

1 As social care can be a mechanism to support people to improve their opportunities and life
2 chances, the capabilities approach may offer an insight into how the benefits of social care
3 technologies might be identified and quantified. However, the individual nature of capabilities
4 raises difficulties when it comes to technologies not purchased by individuals. Nussbaum
5 attempted to identify ten key capabilities that should be supported by all democracies, some of
6 which could be affected by social care (Nussbaum, 2011). The general nature of Nussbaum's
7 capabilities, for example: "Life. Being able to live to the end of a human life of normal length; not
8 dying prematurely, or before one's life is so reduced as to be not worth living."; are neither easy to
9 establish small marginal effect on nor easily valued. If capabilities were identified that were specific
10 enough to social care interventions, when those freedoms are financially constrained, it is unclear
11 what would be valued in any evaluation: the freedom itself or compensation for the inability or
12 inopportunity to be availed of the freedom. Also, unlike health related utility that, when combined
13 with mortality, produces QALYs for which there is a societal value associated, as yet there is no
14 evidence to understand what society might deem appropriate to pay for any increase in capability.
15 In particular, the notion of 'capability maximisation' as an objective has recently been challenged in
16 favour of focusing on the concept of 'sufficient' (Mitchell et al, 2015).

17 Two potential ways forward would be, firstly, to expand the utility basis of QALYs to take account of
18 capabilities (and process). However, this would require knowledge of which elements of utility were
19 included in any measure (similar arguments have been raised regarding the use of bolt-ons to the
20 EQ-5D, see Brazier and Tsuchiya (2015)). Even if the utility elements could be identified and a utility
21 score developed, individuals would be valuing an overall utility score (in the same way that
22 willingness-to-pay (WTP) of overall programmes provides a single monetary valuation of the
23 benefits). This would provide no information on how the individual elements that comprised the
24 score were valued. It would also require the development of a new threshold level to determine cost
25 effectiveness.

1 A second approach would be to use an instrument. One instrument designed to estimate the effect
2 of interventions targeting older people is ICECAP-O (Grewal et al., 2006), where Attachment (love
3 and friendship), Security (thinking about the future without concern), Role (doing things that make
4 you feel valued), Enjoyment (enjoyment and pleasure) and Control (independence) are the
5 functions.

6 Given the diverse nature of social care interventions, a generic instrument would not necessarily be
7 appropriate for any given technology. Furthermore, given the diversity of social care it may be that
8 even condition specific instruments would not be sensitive enough to be of benefit to evaluators.

9 What is required is a way of conceptualising attributes (that might include capabilities) so they can
10 be valued and combined with health benefits. We suggest that it is possible to link capabilities to
11 attributes through a household production framework based on the work of Lancaster (1966).

12 **4.2 ALTs and attributes**

13 In Lancaster's model, individuals use inputs to produce fundamental outputs or more broadly utility.
14 For example, individuals purchase goods and services that provide health attributes and, through a
15 consumption technology, use these inputs to produce health. It is possible to think of capabilities as
16 outputs from this production process, in which case individuals will consume goods and services that
17 provide attributes that can be used to produce capabilities. For example, a key capability may be 'bodily
18 integrity' and individuals would consume goods and services that would provide the attribute 'bodily
19 integrity'. Lancaster's theoretical model allows us to align the attributes of goods with capabilities.

20 If we think of goods as sets of attributes it is possible to see how evaluating ALTs becomes
21 problematic. If we are considering interventions that provide a range of outcomes, and where
22 process may be of value, then it is possible that individuals are willing to trade-off these different
23 attributes against each other. Health care contains attributes of social care and social care contains
24 attributes of health care. They can be substituted for one another, whereas social care attributes

may enhance health care attributes meaning that they are also complements (Wildman and McMeekin, 2014).

Individuals do not value the services 'health care' or 'social care' care but the attributes that comprise 'health care' and 'social care'. For example, the process through which the health care or the social care is provided is a valued attribute. In this case it is useful to be able to value attributes individually. It is also possible that these attributes may be valued differently; for example, process attributes may be valued more highly than health attributes. In this scenario it would not be possible, or would be complex, to use any measure that results in an overall score, such as the QALY, a broader measure like the 'capability-QALY', the 'super-QALY', a WELBY or an instrument such as the Social Care Related Quality of Life (Netten et al., 2012) that covers elements such as 'control over daily life' or "Dignity". With any such approach, the way that domains are incorporated into an overall metric and valued can be methodologically complex and problematic, and often overlooks substitution effects or trade-offs that individuals are want to make. This problem is also true for CBA approaches where the overall intervention is valued using a single WTP value - there is no way to reveal the valuation of the individual attributes that make up the intervention on offer.

4.3 ALT Perspectives

One of the key decisions when undertaking economic evaluation is the perspective: which costs and benefits should be accounted for in the analysis? While it is beyond the scope of this paper to discuss all of the issues relating to perspectives, it is important to note some of the challenges that economic evaluations of ALTs (and other interventions) face. Costs are often considered at the service level but with interventions where costs may be met by different sectors such an approach can be problematic. In many publicly provided health and social care systems the budgets are separate and there is an incentive for the health care and the social care provider to try to shift costs from their budgets. With health care and social care acting as substitutes it is possible that individuals use health care services when they should use social care services. For example, if an ALT

promotes independence, perhaps by aiding mobility, this clearly provides a social care benefit. However, the benefits that arise from cost savings may be largely felt in the health care sector, not only in terms of reduced falls but also by shortening the length of stay in hospital by increasing mobility. Regardless of these problems we believe that the service level is appropriate and below we outline a cost sharing method based on where benefits accrue.

Benefits are usually considered from a social perspective and, in a CUA framework, focus on QALYs. One advantage of the CBA/WTP approach is the ability to incorporate non-health benefits and other potential externalities that may arise from any intervention (externalities may be incorporated by individuals valuing them in their own WTP; for example if an intervention means that care can take place at home then the externality of not requiring someone to take the individual to receive care may be included in the WTP value). Such an approach means that individual valuation may partly take account of preferences of others, such as carers or family members.

With dependent populations, and individuals who may struggle to make decisions in their best interests, perhaps due to cognitive decline, there are many potential beneficiaries (Al Janabi et al, 2016). The treated individual may not be the sole beneficiary from the use of ALTs. Others including public sector bodies, charities, immediate family and carers and more distant families, may also benefit and may be making decisions on behalf of the treated. In the presence of many beneficiaries, and moving away from health as the sole benefit to multi-dimensional benefits that include process, it is valid to ask whose valuations of benefits should be included.

So whose values should count? And should all the identified attributes be included for valuation? It has been suggested that the distinction between patient and public is a false one (Dolan, 1999) while some, such as Gandjour (2010) suggest that nothing beyond the patient's valuations has a

1 theoretical basis. However, such valuations may be problematic due to issues of adaptation (Brazier
2 et al., 2005). Furthermore, for ALTs individual users may be vulnerable, suffer from cognitive decline
3 and are often poor. In such cases valuations that are based on WTP may be particularly affected by
4 ability-to-pay.

5
6
7 It may be preferable that, like the EQ-5D which is based on population-based preferences, the values
8 assigned to attributes should reflect those of the wider population and not just those of the
9 individuals receiving care, their families and associated professionals. If ALTs are to be funded from
10 general taxation then it is right that their benefits should be valued by the wider population. If they
11 are paid for by individuals and their families who obtain benefits, the case for population based
12 valuations is weaker (Gold et al., 1996). This is where the market has clear advantages over public
13 provision. Revealed preference - where the actions of individuals demonstrate their preferences -
14 would demonstrate consumer and family valuations. However, until a wider market has become
15 established this is not currently possible.

16 Given the issues outlined above, especially the issues regarding the potential ability-to-pay bias we
17 recommend the use of population values for the attributes. This is especially important since health
18 states are also being valued at the population level.

19 20 **4.4 Comparators**

21 Finding the correct comparator for any ALT is a challenge due to their complex nature. In any
22 economic evaluation it is good practice to compare a new technology with other alternatives. As
23 Wildman and McMeekin (2014) argue, there are issues when evaluating social care technologies that

1 arise from social care's relationship with health care. In some circumstances it might be necessary to
2 compare a new social care intervention with another social care intervention, whilst at other times a
3 health care technology might be the most appropriate comparator.

7 **5. Valuing outcomes beyond health care**

8 We have highlighted many challenges facing the economic evaluation of ALTs and in this section we
9 outline a new approach to evaluation that overcomes many of these challenges. Many of the
10 problems raised also occur in other areas of economic evaluation and our method could be widely
11 applied to economic evaluations where outcomes beyond health are valued.

12 Our method combines existing evaluation frameworks and a summary is presented in Figure 1. The
13 key feature of this approach is the use of monetary values as a common numeraire across the
14 valuation of attributes/capabilities and the valuation of health. In this way each attribute can be
15 valued, allowing us to identify trade-offs and heterogeneity in valuation and, by using monetary
16 values, providing a mechanism through which social care outcomes can be compared across
17 programs. The health element can be valued in monetary terms through the use of the threshold
18 value that is applied by NICE or via other WTP based approaches. This demonstrates the steps that
19 can be used to evaluate ALTs and other interventions that may have multiple outcomes. It is worth
20 noting that this same threshold could be used to convert monetary values of outcomes and process
21 beyond health into their net-health equivalents (the equivalence between a monetary and health
22 representations of net-benefits is well accepted (Stinnett and Mullahy, 1998)). This may offer some
23 advantages to understanding the trade-offs between the attributes beyond health and health itself.

5.1 Perspective, comparator and attributes

Choosing the perspective and the attributes to be valued needs to be considered simultaneously because the sets of attributes may vary according to perspective. The attributes of importance may be different if we are considering an intervention from a decision makers' perspective compared to an individual perspective, or family/carer perspective.

We suggest that important attributes could be determined by the decision maker or funder (it may be the case that there are important attributes that are valued by the funder). An alternative approach would be to undertake analysis that could identify a range of views and start to bring together important attributes as identified by different populations. These could be populations of decision makers, health and social care professionals, individuals using ALTs or family and carers. One potentially useful method would be Q-methodology. This is a powerful mixed-methods approach that can be used to elicit and group views using factor analysis. An example of applying this method to the public's views on resource allocation can be found in Baker et al. (2014).

Practically, it may not be possible to undertake such an analysis for each new intervention - economic evaluations are only one input into a decision making process and it is important that they themselves are value for money. However, this practical difficulty applies to alternative approaches, even the use of the 'super-QALY' would require considerable analysis to understand which elements of utility should be included. Furthermore, as a new approach there are bound to be learning effects and it may be the case that as more analysis is undertaken researchers iterate towards a set of important attributes.

As in any economic evaluation, it is important to select the relevant comparator. If funding becomes increasingly integrated then health evaluations, which use health measures or QALYs as their

outcome, will need to be compared to evaluations of social care, where QALYs are unlikely to be the most appropriate outcome. In order to obtain comparability between the valuations of benefits, both elements will need to be measured on the same scale. We suggest that the best approach is to measure both sets of benefits in terms of monetary valuations. However, the final decision on the comparator lies with the researcher.

With perspective, the method we are proposing is flexible since the measurement of benefits from health attributes and social care attributes are in the same currency - namely money.

5.2 Valuing social care attributes

Representative samples from the population should be used to value the attributes using WTP methods. There are a number of reasons justifying this position. Firstly, while many countries maintain a right to health care funded by the state and there are QALY thresholds in place, beyond health care there are generally no such frameworks. This is true for any capabilities approach where there is no clear agreement on what should comprise a list of capabilities. In this situation there is neither an agreed threshold value, nor is there, unlike the QALY framework, a clear metric to apply a threshold to. Secondly, obtaining valuations from the population would demonstrate wider WTP for ALTs (or other technologies) that may eventually filter into the private market. Thirdly, the valuations would allow for externalities to be accommodated and, at least in part, account for benefits that accrue to other individuals - such as families or carers. Furthermore, these externalities may stem from both the health care and the social care portion and so incorporate some of the wider benefits arising from health care.

Contingent valuation (CV) approaches (a method of hypothetically valuing outcomes 'contingent' on a market existing) or discrete choice experiment (DCE) methods could be applied. The DCE approach, which elicits preferences across alternatives using a range of scenarios, seems particularly promising since this would enable a first step towards understanding how attributes from social care could be

1 traded-off against one another. In fact, if the health care elements are also included in this valuation
2 exercise then it would be possible to see how individuals made trade-offs between health care and
3 social care, or to investigate the complementarities.

4 There are methodological challenges to be faced in valuation. How does one design a DCE that
5 ensures orthogonality (no correlation) in order to value attributes? Which would be the most
6 appropriate valuation methods; for example, in a DCE should best-worst scaling (Flynn et al., 2007)
7 be used? Another challenge that arises is that of scope, where the sum of the WTP does not equal
8 the total WTP (Drummond et al., 2005). It may be possible to use CV, where individuals are asked to
9 provide values contingent on the existence of a hypothetical market, to value the whole programme
10 but that would not provide information of the valuations of each of the attributes.

12 **5.3 Combining health benefits**

13 As stated above, our key development is measuring the health and social care benefits using the
14 same numeraire, in this case money. Our approach has three main elements: firstly, identify the
15 attributes that underpin the intervention, secondly, obtain monetary values for these attributes
16 using a DCE approach and thirdly, value the health benefit, in money, using either threshold (or
17 revealed decision making) approach, or using WTP based approaches.

18 Once researchers have valued social care and process attributes from an intervention then it is
19 important to combine these with health benefits. There are two ways to approach this problem. The
20 first is to use CBA to value the health portion of any intervention. The outcomes of the CBA would be
21 in monetary terms and could easily be combined with the valuations of the attributes from the DCE.
22 However, this approach would be moving away from the 'extra-welfarist' underpinnings of CUA.

23 A second avenue would be to use CUA. However, this presents a problem of how to combine
24 valuations in terms of QALYs with the monetary valuations of the attributes. There are two

approaches that are available and the approach chosen will depend on whether the evaluator is a searcher or surveyor of the value of a QALY (Baker et al., 2011). A searcher (researchers using threshold values from decision making bodies) could apply the QALY threshold value as used by NICE - conventionally accepted to be around £20,000 - £30,000 per QALY (McCabe et al., 2008). The surveyor (a more welfarist CBA approach) could use the WTP for a QALY based on values from studies such as Donaldson et al. (2011) that obtained values of QALY ranging from £10,000 to £70,000.

In the case where health is evaluated through CUA methods, the net monetary benefit of the health element of any intervention could be derived by multiplying the number of QALYs with the monetary value of a QALY, whether that is derived directly from a threshold value or from values revealed from actual decision making (Claxton et al., 2015) to give health benefits measured in monetary units. These values could then be combined with the attribute values, giving a combination of the CBA and CUA approaches. Standard decision rules, such as ranking interventions on the basis of benefit-cost ratios, could then be applied.

This technique also has the added advantage of addressing (some of) the issues in moving resources between health and social care budgets. By measuring benefits in the same units it would be possible to determine the proportion of benefits deriving from the health and social care outcomes.

In this case it would then be possible to apportion costs on the basis of similar proportions. So, for example, if 60% of the benefits accrued from health then 60% of costs could then be attributed towards health.

The combining of two principal existing economic evaluation techniques into one single framework presents a novel approach to current methods as an immediate and practical solution for evaluating health and social care interventions with outcomes that are necessarily going beyond health. By continuing to capture the impact upon health in terms of a CUA, this is a natural evolution in evaluation methods that enables wider outcomes to be captured and presented alongside health

outcomes — and importantly, the use of CUA maintains the fundamental focus on health for the health portion of the evaluation.

Discussion

This paper presents a method for evaluating interventions where the outcomes may be disparate and process may be valued. This is especially timely with the increasing focus on the integration of health and social care budgets and the interest in preference based methods and cross sector evaluations (Brazier and Tsuchiya, 2015) and where cross sector transfers may occur (Claxton et al., 2010). The basis of the new method is the integration of evaluation methodologies and the inclusion of attributes as a key element of benefit valuation. This approach allows us to value interventions that have social care benefits, process benefits and health benefits. It can also be expanded to include social or business benefits depending on the perspective of the evaluation.

As a first step in the evaluation process, other attributes (beyond health) that are considered relevant and important to the beneficiaries and/or decision-maker need to be identified; i.e. the identification of attributes against which the impact of intervention should be evaluated. With any new method, identifying key attributes will take time and, while an extensive list of attributes may be identified, the attributes used do not necessarily have to be identical across interventions. We propose that by eliciting views to estimate the value placed on wider gains produced by new social care technologies, and combining this with standard health economic methods, a more robust approach could be applied to evaluate interventions reflective of a more integrated health system. This is innovative as it combines current methods associated with both technical and allocative efficiency and would assist decision-makers to allocate resources more efficiently across health and social care budgets. Furthermore, by providing valuations of the benefits of ALTs, evaluations will

1 also provide information for the private market, giving consumers more information regarding the
2 efficacy of ALTs.

3 However, there are key methodological challenges that still need to be overcome. Firstly, it would be
4 helpful if there were an already agreed set of attributes. It may not be feasible to derive the
5 attributes and evaluate them with each intervention and each evaluation. If an appropriate set of
6 attributes and their values could be derived then these could be applied to each evaluation.

7 A second challenge regards the perspective of studies. Where the benefits (and costs) of social care
8 interventions accrue is a difficult matter for evaluators to decide. Such issues are complicated
9 further because social care is often aimed at vulnerable individuals where decision making may be
10 impaired, and where externalities of care - eg the benefits of safety in the home and independence -
11 may be felt by health systems and society as a whole. Furthermore, if there is an increasing drive for
12 the development of a thriving private market in ALTs, then how much should the business
13 perspective also be included in the evaluation? These issues mean that the selected attributes may
14 be different depending on the perspective taken.

15 A third challenge, stemming from the point above, is how to resolve the valuations placed on
16 attributes when the stakeholders involved have different preferences across attributes. We currently
17 suggest using representative samples from the population to value attributes; however it is possible
18 that the methods could be developed further to try and account for the many different views held in
19 the population. If, for example, a person in receipt of care values dignity above all, yet their family
20 members value peace of mind most, how are these different valuations to be reconciled if decisions
21 regarding a technology are made at the family level? There may be a role for methods such as
22 Analytical Hierarchical Processes (Ghodsypour and O'Brien, 1998) that seek to value by consensus by
23 arriving at valuations where the individual discrepancies from the group valuation are minimised.

1 A fourth challenge (that stems from the three already outlined above) is the choice of comparator.
2 While choosing comparators is vital, there is no clear guidance of how to proceed. The advantage of
3 our approach is that since all valuations can be considered in the numeraire of 'money' then the
4 outcomes of interventions do not necessarily have to be identical across trials. For example, while it
5 would be hoped that the lists of attributes valued are similar, they do not need to be identical;
6 comparisons can still occur since the outcomes have a monetary valuation. As more of these types of
7 economic evaluation were conducted the choice of comparator should become clearer.

8 A fifth challenge arises from the valuations of QALYs. Donaldson et al. (2011) have shown that the
9 value society places on a QALY can vary from £10,000 to £70,000 depending of the severity of the
10 condition that the treatment addresses. Whether health and social care should be valued by setting
11 a threshold to maximise output from an exogenously-set health budget or whether it should reflect
12 the value the public put on health and social care, is a broader debate that is beyond the current
13 scope of this paper.

14 The sixth challenge is the decision making process. What would the decision rule be for the
15 interventions evaluated, and who would be the decision maker? Would this role stay within the
16 remit of NICE or should the decision maker include wider representatives from social care? We
17 suggest that the current approach to decision making is maintained. Economic evaluations are an
18 input into the decision making process and our method allows decision makers to be more informed.
19 It is not a decision tool in its own right. This view is largely pragmatic, since NICE has the experience
20 as such a decision maker and a wider discussion of how to integrate health and social care decision
21 making is required.

22 A final challenge concerns aligning the equity elements to the method outlined above. Much of the
23 capabilities literature has focussed on equity and challenges utility based maximisation frameworks
24 (Coast et al. 2008c, Mitchell et al., 2015). Equity issues could be incorporated through the valuation

of attributes and social valuations of QALYs (Lancsar et al., 2011) or through the decision making processes. These are issues that are still unresolved in much of the economic evaluation literature.

Conclusion and suggestions

This paper considers the issues relating to the economic evaluation of interventions such as ALTs that may provide social care benefits, health care benefits and process benefits, all of which are valued by the end user and, potentially, also by families, carers and society more broadly.

An ageing population and an increasing number of people with complex health needs requiring integrated care, together with continued pressure on health and social care budgets, mean that the need to ensure that resources are allocated in the most efficient way is increasingly important (Mason et al., 2014). Techniques for evaluating health care technologies have been established. However, social care technologies present a set of challenges beyond those typically encountered when conducting economic evaluations of health care technologies.

A mixed methods approach that uses qualitative methods to identify the attributes of social care technologies that individuals value and values these attributes using quantitative techniques would allow cost-utility and cost-benefit analyses, to be carried out together. This would be a significant step in an area that has so far been without the tools available to decision makers in healthcare. The downsides of the approach we propose result from its complexity. It means that research would need to be undertaken to establish which attributes were relevant to a particular technology. However, while it might not be possible or desirable to develop a generic instrument and a universal set of values, as the evidence base grew the opportunities to use data from previous economic evaluations would increase. Ultimately, the decision about whether to adopt a methodology such as we propose depends on whether complexity and cost outweigh the uncertainty around the social care technology and the financial consequences of adopting an inefficient technology ahead of a better alternative.

There are many challenges still to be addressed but we believe that we have started to clarify economic evaluations of ALTs. Many of our arguments echo those expounded in Coast et al. (2008a) although our application is broader than health interventions and covers interventions that are at the forefront of integrating health and social care.

In conclusion we raise considerations for researchers conducting economics evaluations outcomes are complex and processes are also potentially of value.

1. What is the perspective of the economic evaluation? Who are the main beneficiaries - patients/consumers, carers, health and social care systems, businesses, etc?

2. Select the attributes of the intervention using Q-methodology. We hope that further research can identify key attributes; however, it may be that for each economic evaluation attributes can be identified by researchers or funders, or that qualitative methods can be used of obtain key attributes from individuals and family members.

3. Will the health attribute(s) be separated from the social care and the process attributes?

4. How will valuation occur? If health is a separate attribute will it be valued through CUA or CBA? If the former, what value of a QALY will be assigned? Will a DCE be used for the other attributes?

Acknowledgements

Authors Wildman and McMeekin acknowledge funding as part of the SALT project. Grieve and Briggs acknowledge funding as part of the dallas programme. SALT was funded by Innovate UK (formerly known as the UK Technology Strategy Board). The dallas programme is being funded by Innovate UK, the National Institute for Health Research, the Scottish Government, Highlands and Islands Enterprise, Scottish Enterprise as well as local consortia. The views expressed in this paper are those of the authors and not necessarily those of Innovate UK or any of the dallas funding bodies

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21

REFERENCES

Appleby, J (2013) *Spending on Health and Social Care Over the Next 50 Years: Why Think Long Term?*, The King's Fund, London

Al-Janabi, H., van Exel, J., Brouwer, W. and Coast, J. (2016) A Framework for Including Family Health Spillovers in Economic Evaluation., *Medical Decision Making* 36(2) 176-86

Baker, R., Bateman, I., Donaldson, C. et al (2011) *Weighting and valuing quality-adjusted life-years using stated preference methods: preliminary results from the Social Value of a QALY Project*, *Health Technology Assessment (Winchester, England)* 14 (27)

Baker, R., Wildman, J., Mason, H. and Donaldson, C. (2014) Q-Ing for Health—A New Approach to Eliciting the Public's Views On Health Care Resource Allocation *Health Economics* 23 (3), 283-297

1 Birch, S. and Donaldson, C. (2003) Valuing the benefits and costs of health care programmes:
2 where's the 'extra' in extra-welfarism? *Social Science & Medicine*, 56, pp. 1121–1133
3

4 Brazier, J., Akehurst, R., Brennan, A. et al. (2005) Should patients have a greater role in valuing
5 health states? *Applied Health Economics and Policy*, 4, 201-208
6

7 Brazier J & Tsuchiya A (2015) Improving Cross-Sector Comparisons: Going Beyond the Health-Related
8 QALY. *Applied Health Economics and Health Policy*, 13(6), 557-565.
9

10 Buxton, M. (2008) Discussion of Paul Dolan and Aki Tsuchiya's paper: 'The measurement and
11 valuation of public safety'. In *The Ideas and Influence of Alan Williams*, eds Mason, A. and Towse, A.,
12 OHE, London
13

14 Claxton, K., Walker, S., Palmer, S. and Sculpher, M. (2010) Appropriate perspectives for health care
15 decisions. *Centre for Health Economics Working Paper No. 54*, University of York, York.
16

17 Claxton, K. P., Martin, S., O Soares, M., Rice, N., Spackman, E., Hinde, S., Devlin, N., Smith, P. C. &
18 Sculpher, M. (2015) Methods for the Estimation of the NICE Cost Effectiveness Threshold. *Health*
19 *Technology Assessment*, 19 (14)
20

21 Coast, J., Flynn, T.N., Natarajan, L. et al. (2008a). Valuing the ICECAP capability index for older
22 people. *Social Science & Medicine*, 67 (5) 874-882
23

24 Coast, J., Smith, R.D. and Lorgelly, P. (2008b) Welfarism, extra-welfarism and capability: The spread
25 of ideas in health economics, *Social Science and Medicine*, 67(7) 1190-1198
26

Coast, J. Smith, R.D. and Lorgelly, P. (2008c) Should the capability approach be applied in health economics? *Health Economics*, 17, pp. 667–670

Colombo, F., Llena-Nozal, A., Mercier, J. and Tjadens, F. (2011) *Help Wanted? Providing and Paying for Long Term Care*, OECD Health Policy Studies, OECD

Cookson R. (2005) QALYs and the capability approach. *Health Economics* 2005; 14(8):817-829.

Culyer, A J, (1989) "The Normative Economics of Health Care Finance and Provision," *Oxford Review of Economic Policy*, Oxford University Press, vol. 5(1), pages 34-58, Spring.

de Leonibus, V., Bartosova, R. and Lewis, E. (2012) *ALT market in the UK*, Aktive Report on behalf of Innovate UK (formerly the Technology Strategy Board).

Dolan, P. (1999) Whose preferences should count? *Medical Decision Making*, 19 (4), 482-486

Donaldson, C. (1999). Valuing the benefits of publicly-provided health care: does 'ability to pay' preclude the use of 'willingness to pay'? *Social Science and Medicine*, 49, 551-63.

Donaldson, C., Baker, R., Mason, H. et al. (2011). The social value of a QALY: raising the bar or barring the raise? *BMC Health Serv Res*, 11, 8.

Drummond, M. F. 2005. *Methods for the economic evaluation of health care programmes*, Oxford, Oxford University Press.

Flynn, T. N., Louviere, J. J., Peters, T. J., & Coast, J. (2007). Best-Worst Scaling: What it can do for health care research and how to do it. *Journal of Health Economics*, 26(1), 171-189

Gandjour A. (2010) Validity of Patient vs Population Preferences in Calculating QALYs. *Medical Decision Making*, 30(4):E57–63

Ghodsypour, S. H. & O'Brien, C. (1998). A decision support system for supplier selection using an integrated analytic hierarchy process and linear programming. *International Journal of Production Economics*, 56-7, 199-212.

Gold M.R., Siegel J.E., Russell L.B., Weinstein M.C. (1996) *Cost-Effectiveness in Health and Medicine*. New York: Oxford University Press

Graybill, E.M., Wildman, J. and McMeekin, P. (2014) Can Aging in Place be Cost Effective? A Systematic Review, *PLOSOne*

Grewal, I., Lewis, J., Flynn, T., Brown, J., Bond, J. and Coast, J. 2006. Developing attributes for a generic quality of life measure for older people: Preferences or capabilities? *Social Science & Medicine*, 62, 1891-1901.

Ham, C., Dixon, A. and Brooke, B. (2012). The drivers of change. *Transforming The Delivery of Health and Social Care. The case for fundamental change*. London: The Kings Fund.

Henderson, C., Knapp, M., Fernandez, et al. (2013). Cost effectiveness of telehealth for patients with long term conditions (Whole Systems Demonstrator telehealth questionnaire study): nested economic evaluation in a pragmatic, cluster randomised controlled trial. *British Medical Journal*, 346.

1

2 Hurley, J. 2014. "Welfarism and Extra-welfarism." In A. Culyer, Ed., *Encyclopedia of Health*

3 *Economics*, Vol 3. San Diego: Elsevier, pp. 483-489.

4

5 Lancsar, E., Wildman, J., Donaldson, C., Ryan, M., and Baker, R. (2011). Deriving distributional

6 weights for QALYs through discrete choice experiments, *Journal of Health Economics*. 30(2), pages

7 466-478.

8

9 Lancaster, K.J. (1966) A New Approach to Consumer Theory, *The Journal of Political Economy*, Vol.

10 74, No. 2 pp. 132-157.

11

12 Li, F., Armitage, G., Wildman, J. et al. (2011) *Designing Scalable Assistive Technologies and Services*

13 *for Independent Healthy Living and Sustainable Market Development in the Mixed Digital Economy*

14 *(SALT)*, mimeo Newcastle University

15

16 McCabe C, Claxton K and Culyer AJ. (2008) The NICE cost-effectiveness threshold: what it is and what

17 that means, *Pharmacoeconomics*, 26(9):733-44.

18

19 Mason, A., Goddard, M. and Weatherly, H. (2014) *Financial mechanisms for integrating funds for*

20 *health and social care: an evidence review*, CHE Research Paper 97

21

22 Mitchell, PM, Roberts, TE, Barton, PM and Coast, J, (2015), Assessing sufficient capability: A new

23 approach to economic evaluation. *Social Science & Medicine*, 139., pp. 71-79

24

Netten AP, Burge P, Malley J, Potoglou D, Towers AM, Brazier B, Flynn T and Wall J (2012). *Outcomes of social care for adults: developing a preferences weighted measure*, Health Technology Assessment, 16.

Nussbaum, M. C. 2011. *Creating Capabilities*, Harvard, Harvard University Press.

Sen, A. K. (1980). Equality of What. In: McMurrin, S. M. (ed.) *The Tanner Lecture*. Salt Lake City: University of Utah Press

Sen, A. (2002). Development, capabilities, and freedom - Response to commentaries. *Studies in Comparative International Development*, 37, 78-86.

Steventon, A., Bardsley, M., Billings, J. et al. (2013) Effect of telecare on use of health and social care services: findings from the Whole Systems Demonstrator cluster randomised trial. *Age and Ageing*, 42, 501-508

Stinnett, A.A. and Mullahy, J. (1998) Net health benefits: a new framework for the analysis of uncertainty in cost-effectiveness analysis. *Medical Decision Making*, 18, S68-80

Wildman, J. and McMeekin, P. (2014) "*Health care and social care: complements, substitutes and attributes*," MPRA Paper 54425, University Library of Munich, Germany.

Figure 1: Evaluation Guide

